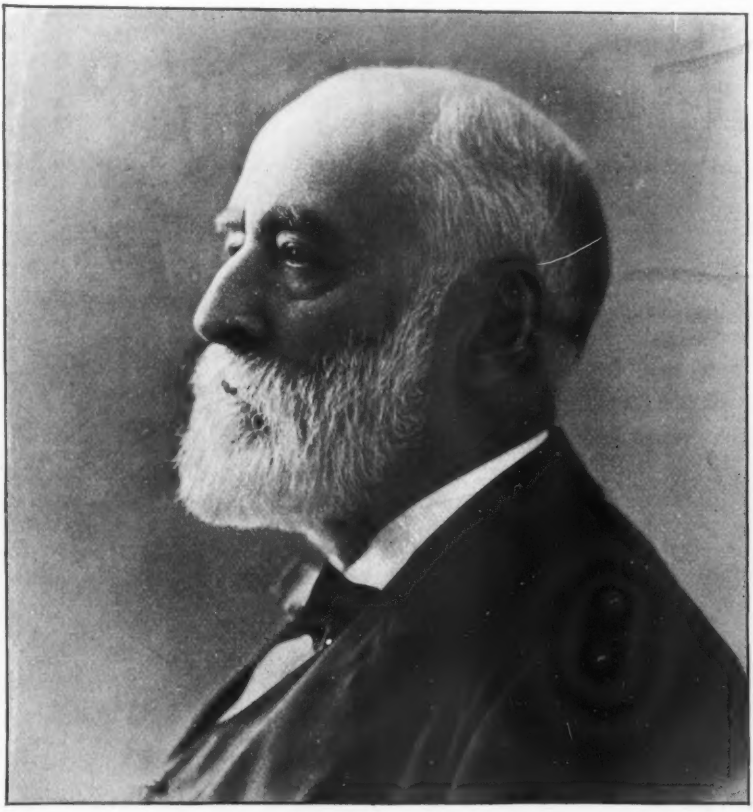
UNIV. OF MICH.
18 JUN 1897

Compressed Air

DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

VOL. II. NEW YORK, JUNE, 1897. No. 4



THOS. DOANE, ESQ.

LIDGERWOOD M'F'G CO.,

Boston.
Philadelphia.
Cleveland, O.

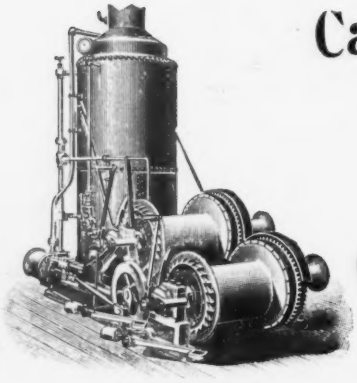
96 Liberty Street,
New York.

Chicago.
Portland, Ore.
New Orleans.

STANDARD

High . . .
Speed
Hoisting Engines.

Built on the Duplicate Part System.



Cableways,
Hoisting
and
Conveying
Devices,

For Canal and Trench Excavating, Dam Construction, Wall and Pier Building, Mining, Quarrying, Logging, and General Contract Work.

FISKE BROTHERS REFINING CO.

— HIGH GRADE —

LUBRICANTS

Trade Mark.

Fiske Brothers. Sole Manufacturers.
LUBROLEINE
N.Y. U.S.A.

SPECIALLY MANUFACTURED FOR

AIR COMPRESSORS, AIR DRILLS, STEAM DRILLS, STEAM ENGINES.

OFFICE AND SALESROOM:
59 WATER STREET,
NEW YORK, U.S.A.

McNAB & HARLIN M'F'G CO.,

MANUFACTURERS OF

BRASS COCKS,

PLUMBERS' BRASS WORK,

Globe Valves, Gauge Cocks, Steam Whistles and Water Gauges,

WROUGHT IRON PIPE AND FITTINGS,

Plumbers' and Gas Fitters' Tools,

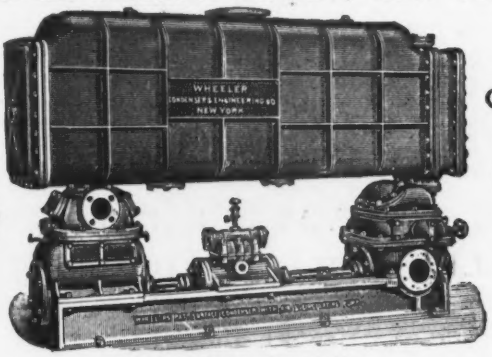
No. 56 JOHN STREET, - - NEW YORK.

Factory, Paterson, N. J.

Wheeler Condenser & Engineering Co.

120 & 122 LIBERTY STREET, NEW YORK.

For MARINE and STATIONARY SERVICE.

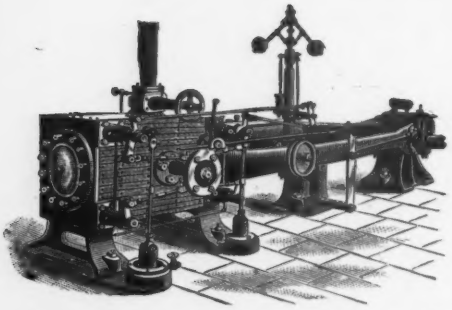


SURFACE CONDENSERS Mounted on Combined Air and Circulating Pumps.

PROPRIETORS AND MANUFACTURERS OF

WHEELER STANDARD SURFACE CONDENSER; WHEELER ADMIRALTY SURFACE CONDENSER; WHEELER LIGHTHALL SURFACE CONDENSER; VOLZ PATENT SURFACE CONDENSER AND FEED WATER HEATER; EDMISTON PATENT FEED WATER FILTER.

WHEELER'S PATENT FEED WATER HEATER.



Established
1833.

The
C. & G. COOPER CO.

MT. VERNON, OHIO.

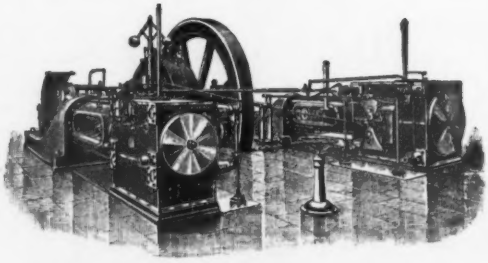
CORLISS ENGINES.

COMPOUND.

TRIPLE EXPANSION.

SINGLE CYLINDER.

Of all sizes up to 3,000 Horse-power.



— FOR —

FACTORIES, RAILWAYS, ELECTRIC LIGHTING, ROLLING MILLS, AND ALL KINDS OF MANUFACTURING.

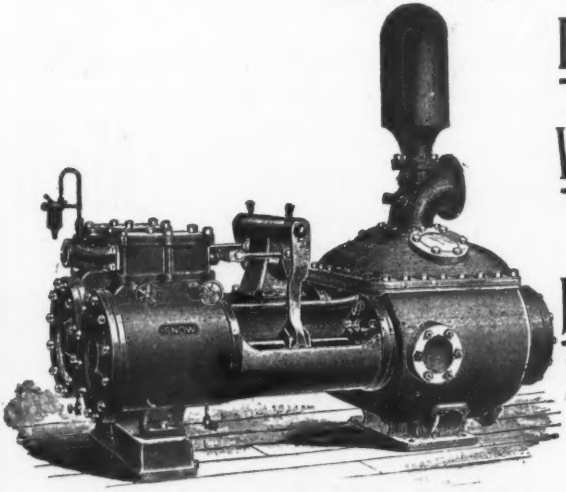
CORRESPONDENCE SOLICITED.

HOME OFFICE: MT. VERNON, OHIO.

NEW YORK: Room 1022 Havemeyer Building, F. W. IREDELL, Mgr.

The Snow Steam Pump Works,

MANUFACTURERS OF



Pumping Engines,

Water Pumps

AND

Hydraulic Machinery

For Manufacturing Purposes,
Waterworks and all
Other Purposes.

N. Y. OFFICE, 126 LIBERTY STREET, NEW YORK CITY.

The FOSTER

New "Class W"
(Automatic)
Pressure
Regulator.

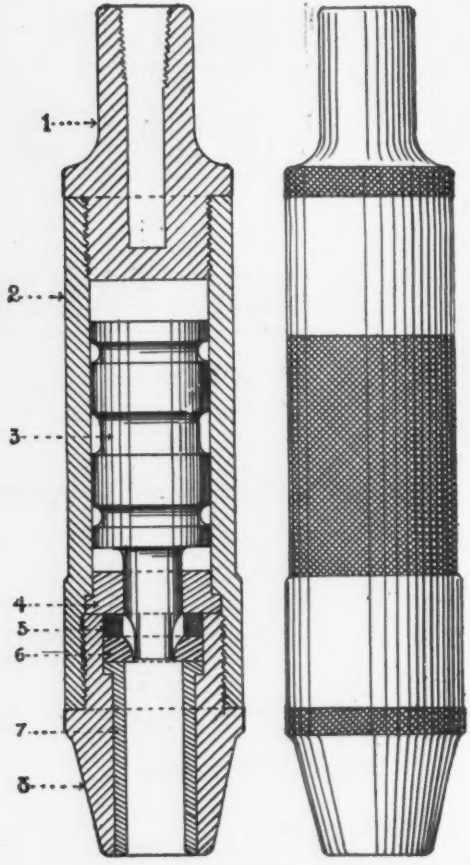
The only Pressure Regulator satisfactorily controlling High Initial Air Pressures.

In successful service on ALL the AIR-MOTORS yet tested.

FOSTER ENGINEERING CO.,

NEWARK, N. J.

Keller Pneumatic Stone and Metal Cutting Tool!



Parts

1. *Inlet piece*
2. *Cylinder*
3. *Hammer*
4. *Hammer Washer*
5. *Leather Washer*
6. *Tool Washer*
7. *Steel bushing*
8. *Nose*

Absolutely Valveless.

Patented November 12, 1895.
" May 26, 1896.

Furnished subject to ten days trial.

These Tools have always been preferred when comparative tests with other tools have been made.

Write for Circular and List of Parties Using this Tool.

MANUFACTURED BY

C. H. HAESELER CO.,

1026-1030 Hamilton Street, - - - Philadelphia, Pa.

"Phoenix" Pneumatic Drills, Reamers and Tappers, Breast Drills, Hoists, Compressors, Sand Sifters and Motors.

Everything in the line of Pneumatic Equipment.

THE PELTON WATER WHEEL

Embracing in it variations of construction and application

THE PELTON SYSTEM OF POWER.

In simplicity of construction, absence of wearing parts, high efficiency and facility of adaptation to varying conditions of service, the **PELTON** meets more fully all requirements than any other wheel on the market. Propositions given for the development of water powers based upon direct application, or **Electric Transmission** under any head and any requirement as to capacity.

Compressed Air Transmission.

No other wheel is so well adapted to this purpose. Where the head admits, it can be attached to compressor shaft direct, and serve for prime mover and fly wheel as well.

Correspondence Invited. Catalogues Furnished upon Application. Address,

PELTON WATER WHEEL CO.,

121-123 MAIN STREET, SAN FRANCISCO, CAL.

143 LIBERTY STREET, NEW YORK.

BOSTON. NEW YORK. PITTSBURG. CHICAGO. ST. LOUIS.

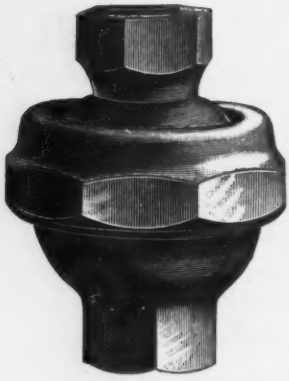
National Tube Works Company,

MANUFACTURERS OF

Standard Steam, Gas and Water Pipe.
Locomotive and Stationary Boiler Tubes.
Special Flanged Pipe for Compressed Air.
Pump Columns for Mines.
Special Light Lap-Welded Pipe, fitted with the Converse Patent Lock Joint for Water and Gas Mains.
Cylinders with Dished or Flat Heads for Carbonic Acid and other Gases.

NEW YORK OFFICE: HAVEMEYER BUILDING.

An Important Connecting Link in Compressed Air Service



The Moran Flexible Joint

For high pressure, indispensible.

Tightness, safety, flexibility and durability assured.

Parties making experiments with Compressed Air may have the use of the "Moran Joint," free for a limited time.

MORAN FLEXIBLE STEAM JOINT CO.,

LOUISVILLE, - - - - - KENTUCKY.

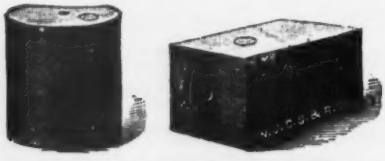
ESTABLISHED 1858.

"Our Name and Brand a Guarantee of Quality."

High Grade Rubber Goods.

CHANNELING SPRINGS.

BELTING.
TUBING.
VALVES.
HOSE
TUBING.



SPRINGS.
MATS.
MATTINGS.
GASKETS.
PLAY PIPES.

LINEN AND COTTON HOSE.

NEW JERSEY CAR SPRING & RUBBER COMPANY,

MAIN OFFICE AND WORKS:

Wayne and Brunswick Streets, Jersey City, N. J.

BRANCH OFFICE: 10 BARCLAY ST., NEW YORK.

Compressed Air.

A MONTHLY PUBLICATION DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

W. L. SAUNDERS, - - Editor and Publisher
A. E. KENNEY, - - - Managing Editor
J. E. QUINTERO, } - - - - - Associates
F. C. WEBER, }

Subscription, including postage, United States, Canada and Mexico $1.00 a year. All other countries, $1.50 a year. Single copies, 10 cents.

Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

All communications should be addressed to COMPRESSED AIR, 26 Cortlandt St., New York.

London Office, 114a Queen Victoria Street.

Those who fail to receive papers promptly will please notify us at once.

Entered as Second-Class Matter at the New York, N. Y., Post Office.

VOL. II. JUNE, 1897. NO. 4.

COMPRESSED AIR has from time to time published illustrations and descriptions of compressed air appliances in railroad shops. We have endeavored to exercise care in dissociating patented and theoretical designs from those which have been put into practical operation and which have established themselves in a field of usefulness. We illustrate in this number some of the successful applications of compressed air in railroad shops, the cuts being made from photographs taken by our representative.

In no class of work has compressed air such a varied usefulness as in shops, and it is much to the credit of the mechanical engineers connected with railroad shops that they should have assumed the initiative in this important industrial use of air and that they have developed it to so large an extent. We understand that Mr. Gordon, Master Mechanic of the P. W. & B. shops at Wilmington, Delaware, about the year 1882, and Mr. Dolbeer at the Renovo shops of the P. R.R. about the same time, were pioneers in the application of compressed air to railroad shops. We will be glad to have the names of persons who may have applied air to the shops prior to the date given. The first application was, we believe, to a hoist. Those who are familiar with railroad shops know the importance of a small, portable and powerful hoist, and we are quite safe in saying that prior to the introduction of the air hoist there had been nothing which met the requirements so well. Next in importance to the hoist is the application of air to portable motors, such as drills, reamers, taps, riveters, chipping tools, etc Such uses can hardly be called exclusive, as other powers have been applied with, we think, less economy and success. There are, however, certain exclusive applications of air, such as cleaning cars, painting and pumping, which have of late come into general use, and which invariably argue as a good reason why a compressed air plant should be installed in the shop. There are many things now done by compressed air which might be done by electricity, but there are few things which electricity can do in a shop which cannot be done equally as well by air. Air power has a more general application and has a greater field of usefulness in a shop. With the single exception of lighting, what is there about a shop which can be done by electricity for which compressed air is not just as applicable? The great advantage of electricity is in long distance transmission of large powers and in the ease with which it is subdivided and distributed. These advantages are not apparent in a shop equipment. The power distributed is usually small and easily transmitted throughout the limits of the shop with practically no loss by friction. Piping a shop is an easier operation than wiring; the tools are at hand, and the men, down to the most inexperienced, are capable of understanding and managing a pipe line. There is less liability to leakage, because when air leaks it whistles, while with electricity much loss might oc-

cur for months or years without discovery. There is always the element of danger by fire and otherwise in an electric installation, while air is so safe that it has been called the "humane power." We have no doubt that, when properly understood, insurance rates might be affected favorably to an air plant. It certainly seems desirable in a place where there is so much oil and so many combustible elements to use that power which, when generally distributed throughout the shop, is perfectly safe. As air and electricity are both secondary powers, it costs perhaps as much to produce one as the other; but in any system where the use of the power is variable and intermittent, air is more economical. Upon this point we can stand with much assurance. If the motor does not consume air, the generator is simply reduced in speed or stopped altogether by an automatic governor. But we have heard it said that the most important advantage in air over electricity is that air machines are easily understood by the men in the shop, and if anything happens repairs may be promptly made. Trouble in an electric plant calls for a telegram to the electrician, who is not always as available as he is expensive.

Thomas Doane, Esq.

(Cover.)

Mr. Thomas Doane, of Charleston, Mass., was born in Orleans, Mass., Sept. 20, 1821, and is the son of John Doane, who was the originator in this country of "forest culture," and also filled many important public offices.

The career of Mr. Doane covers a wide field of engineering usefulness, and we are pleased to designate him the "Pioneer" of compressed air in this country. In following his profession of civil engineering and surveying he has been identified in a conspicuous manner with Windsor, White River Division of the Vermont Central R.R.; the Cheshire R. R. at Walpole, N. H., and the Boston & Maine R. R.

In 1869 he built 141 miles of railroad on the extension of the Chicago, B. & Q. R. R. He located and named all the towns on the extension. While in Nebraska he established what is now known as Doane College, at Crete, twenty miles West of Lincoln. He was engaged in the reconstruction of the Troy & Greenfield R. R. In 1875 he was appointed Consulting and Acting Chief Engineer of the Northern Pacific R. R. He located the Pence d'Orville Division of the road across the Columbia Plains in Washington Territory and parts of the Missouri Division in Dakota. The entire road was built under specifications written by Mr. Doane.

It is in his connection with the Hoosac Tunnel that Mr. Doane devoted himself to the perfecting of compressed air machinery. As Chief Engineer he located the line of the tunnel, built the dam in the Deerfield River to furnish water power for compressing air and for a machine shop, and in this work introduced nitro-glycerine and successful electric simultaneous blasting for the first time in this country. He introduced compressed air and invented and patented machinery for it, and had a large share in inventing the pneumatic drill and their carriages used there.

In his book on tunneling, Mr. Henry S. Drinker refers to Mr. Doane as follows: "So many able and distinguished engineers and contractors have, during the progress of the Hoosac Tunnel, contributed in a greater or less degree to its final success, that it would be out of place in a work such as this purports to be, for the author to attempt to give especial credit to any where so much was done by all, in the work of the tunnel proper. But Mr. Doane's connection with the Hoosac Tunnel in the early days of that great work is not a matter of especial but of universal interest to the engineering profession in America; for his persisteut energy, his farseeing sagacity and his able management, we in a large measure and in fact chiefly, owe the development and introduction into this country of the present advanced system of tunneling with machinery and high explosives. It was under his directions, as engineer of the Commission, that the State experiments were made, and the long and disheartening fight carried through, which terminated in favor of the new system. The system which has since given us the Burleigh, Ingersoll and Wood drills, and which also first showed Americans practically what the potent agency of nitro-glycerine, first applied by Nobel in Europe, in reality was."

As early as 1873 he proposed a com-

pressed air power plant to do away with the endless number of boilers and fires that are used in closely built cities. The suggestions contained in an article printed at that time tally accurately with ideas that are being brought out at the present time, and show that even though he succeeded in carrying out his ideas in the Hoosac Tunnel, he was still many years ahead of the time. He now enjoys a ripe old age, doing business in the same room where he took his apprenticeship, vigorous in both mind and body. We wish him continued health, happiness and prosperity.

Air for Ship Building.

Compressed air for ship building is being used extensively in the large ship yards of the country. Following is a record of its use at the Chicago Ship Building Company's yard :

They commenced to use compressed air in this plant about two years ago, putting in at that time a couple of pneumatic hammers for caulking and chipping in the machine shop and outside on ships under construction. This part of the plant has been in constant use ever since, and with very great success. Both edge caulking and butt caulking are done much more rapidly and cheaply than either can be done by hand, and make better work in every respect. About eighteen months ago they started to experiment with portable pneumatic compression riveters for use in driving rivets in ships on the stocks. The riveter was the ordinary form of bow riveter, and the only trouble had with it was in arranging to handle it quickly in the ship. After considerable experimenting, a rig was finally gotten up which enabled them to pass rapidly from one rivet to another, and they have used these riveters with much success ever since on a number of vessels.

Last summer it occurred to the company to experiment with the pneumatic hammers for driving rivets, and in connection with a pneumatic holder-on, which was devised by themselves, the result in that class of work has been very satisfactory.

The latest application made is in the form of a light wrought iron bow of about 4½ ft. gap, with a hammer fastened on one side and a pneumatic holder-on on the other side. This is suspended by a chain fall from a portable section of overhead tramway, and has been very successful in use. The whole arrangement weighs only about 400 lbs., against a weight of nearly a ton on a compression riveter of the same gap and capacity. Altogether they are driving now from 15 to 20 per cent. of all the rivets in the ships by these riveters.

Pneumatic reamers for fairing the rivet holes have been adopted, and a number of them are in use. Two men with one of these power reamers can do the work of six or eight men working by hand, and on some classes of work can ream as many as three thousand holes a day. Pneumatic hoists are also used to some extent in the shops, and the extension of the application of the air goes along at a rapid rate.

The first compressor put in had a capacity of about 200 cubic feet free air per minute, and the one now being used has about 800 cubic feet capacity. Air is used at a pressure of from 90 to 100 lbs. Compressed air machines of their own designing are used for painting and whitewashing the shops and for painting the iron work on ships. They find it works very well on a plain flat surface like the outside of the hull, but it has not been very successful on the inside work.

Ballast Injector.

A compressed air apparatus for placing ballast under depressed railroad ties has been invented It consists of a small Root Blower run by hand, and a double-tubed injector. The blower is clamped upon a rail for support. It supplies air through a flexible hose to the injector, which has a hopper at the top. Suitable ballasting material is fed to the hopper. Air is allowed to flow through the air supply pipe, and the ballast is drawn from the hopper. Air and ballast meet at the bottom of the tubes. The air carries the ballast under the tie from one end nearly to the other. It operates with great nicety, and has been experimentally tried on several roads. It does not displace the ballast at the sides of the tie. No tamping by hand is necessary. The inventor claims great saving in cost in ballast, heretofore requiring expensive work in surfacing.

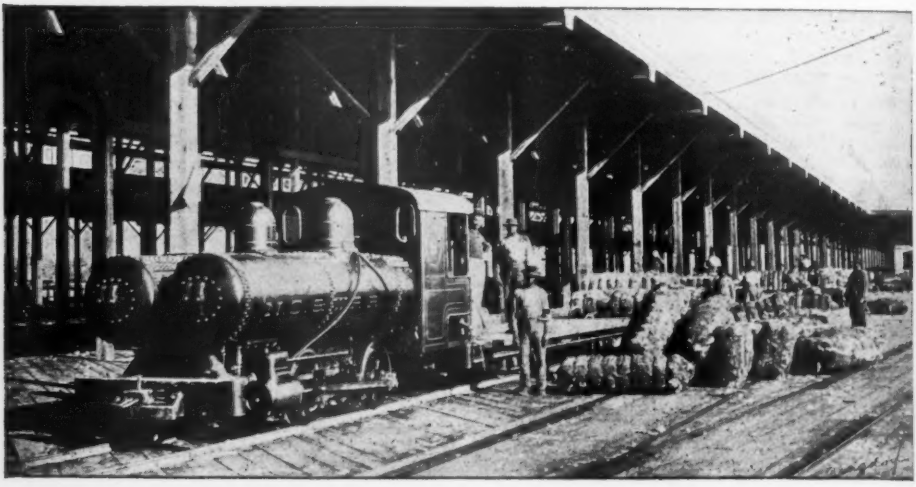
Electric Cotton Hauler at Port Chalmette, La.

Electrical Engineer, Feb. 17, '97.

There has recently gone into operation an interesting electric freight hauling road at Port Chalmette, La., of which we give several views in the accompanying engravings.

Port Chalmette is the big cotton handling port recently constructed just below New Orleans on the Mississippi. At this point over $3,000,000 has been expended in cotton sheds, warehouses, compresses and wharves. The whole forms a town to itself, lighted by its own electric lighting plant, with arc lights and 220-volt. incandescent lamps. Connecting the sheds, warehouses, compresses and wharves is a system of narrow gauge tracks for handling the cotton.

The original promoters adopted compressed air locomotives for the work of hauling the cotton about from point to point. At the beginning of the cotton season last fall, although four air locomotives were in service, they were unable to cope with the handling and moving of the cotton. The managers were skeptical regarding electric traction, and the underwriters were afraid that electric motors would increase the fire risk. Something had to be done, and done quickly, to handle the large consignment of cotton daily received. A temporary trolley line was constructed and an electric truck provided. An engine and railway generator were hastily secured, and inside of ten days the most important part of the hauling work was being successfully handled by the improvised trolley plant. Its working satisfied both the Chalmette managers and the underwriters, and the result was a contract was made for four electric haulage locomotives. The apparatus was rapidly installed, and by the middle of the cotton season the trolley had supplanted the compressed air locomotives and was taking care of the large and extended haulage system of the entire terminal.



COMPRESSED AIR LOCOMOTIVE, PORT CHALMETTE, PA.

The locomotives are "factory trucks," equipped with two NWP—12 motors, and weighing approximately 15,000 pounds;

each is capable of hauling 150 tons on a straight level track.

Current is furnished by a 500-volt railway generator direct coupled to a 300 h. p. Erie City Iron Works engine. The electrical apparatus was furnished by the General Electric Co., through Mr. J. J. Britton, of the New Orleans office.

There are about eight miles of 36-inch gauge-track about the cotton sheds, storage warehouses and wharves.

COTTON TRAIN AT PORT CHALMETTE - COMPRESSED AIR LOCOMOTIVE.

Editor COMPRESSED AIR:

DEAR SIR: My attention has been called to an article in "The Electrical Engineer" of February 17th, 1897, entitled "Electric Cotton Hauler at Port Chalmette, La." As Chief Engineer and General Manager, I planned the entire works of Port Chalmette, and the Belt Railway around New Orleans, and in the same capacity I planned and had built a compressed air plant equipped with pneumatic locomotives, to do the cotton hauling and handling at that port.

During my management these pneumatic locomotives and compressed air system gave entire and complete satisfaction. Repeated tests were made and the results fully described at the time in different technical journals.

I resigned last summer to go to Europe, and during my absence the engineering department and the power plant at Chalmette fell into the hands of a person who had never heard of compressed air until he accidentally happened to see the plant at Port Chalmette. The Chief Engineer was a very good man, who had graduated in the science of engineering as levelman of a cotton compress.

As near as I can learn, it appears that, for instance, he attempted to run the plant without opening the valves supplying the compressed air to the locomotive tanks. At all events, the compressed air plant which up to that date had been a perfect success, all at once appeared inefficient, and the local directors (their inexperience can be readily pardoned), in their anxiety to keep things going, sent for and used electric motors as described in said number of "The Electrical Engineer."

These electric motors have about one-

third of the hauling capacity of the pneumatic locomotives, are more expensive on account of the fuel consumed, and have the ever present danger of sparks in a cotton yard.

As soon as the end of the cotton season permits any changes to be made at Port Chalmette, the compressed air plant there will again receive prompt attention.

Yours very truly,

A. W. SWANITZ,
Consulting Engineer.

ROBT. HARDIE AND HIS MOTOR.

The Hardie Air Motor.

Mr. Frank Richards, in a letter to the New York "Sun," speaking of the cars running on 125th street, New York, says: "Each car is independent of every other, and independent of the roadbed. The disablement of one car affects only itself. It is the safest system known. No passenger has ever discovered or suggested an objection. The officers of the Third Avenue Railroad Co., upon whose lines the cars have run, have entirely failed to discover any objection to the system, and state so officially." Mr. Albert J. Elias, President of the Third Ave. R.R. Co., N. Y., in a letter to Mr. E. A. Williard, President of the American Air Power Co., dated March 31st last, writes:

"Your cars operated by compressed air have been steadily operated on the 125th Street line of the Third Avenue Railroad Co. since the 3d of August last. They have been easily handled, started, stopped and reversed; the last named quality being a very desirable feature, reducing the liability to accidents. Of course the advantage of a motor that operates independently of connection with any subterranean motive power is apparent. I have not been able accurately and definitely to determine the relative cost of this compared with other motors, but am quite sure that it is not greater, and am of the impression that it is less than animal and probably less than cable traction. The motors are capable of attaining high speed and overcoming considerable gradients."

The following from the "Railroad Gaz-

ette" shows that the Hardie system is attracting attention abroad :

"Sir A. B. Forwood, a large owner in the Liverpool, Eng., tramway system, before the city acquired the plant, has been for a considerable time making an investigation by direction of the Liverpool authorities for the purpose of report, of the working of the Hardie Air Motor on 125th street, New York. He employed as an expert, Mr. A. Thomson. The report which has been forwarded contains detailed description of the motors and plant now in use in New York, together with estimates of cost of their working. The report concludes as follows : 'Looking at this system from a mechanical point of view, there appears to be no doubt of its efficiency. The details connected with the service which we examined have been very carefully wrought out and constructed, and the machinery appeared to have sustained no wear and tear of any moment after continuous service of about eight months. The arrangement of the machinery in the car is that of a plain simple engine, the working parts are of good strong section and design, and should last for a long time with a very little upkeep, and we have no hesitation in stating that a plant fitted upon this system, with the arrangements and details carried out properly to begin with, would work as great or greater efficiency and more economy than any other system which we are acquainted with.'"

We publish in this issue two statements; one is the report of electric motors being substituted for compressed air locomotives, and the other is its sequel, being a letter from Mr. A. W. Swanitz, the Consulting Engineer of the New Orleans & Western R.R. at Port Chalmette, La.

To the credit of the Electrical Engineer whose report we copy, it may be said that its statements were practically correct. Very different from the other electrical papers, whose accounts we have seen. They danced around the alleged compressed air failure in unrestrained glee. The statement of Mr. Swanitz refutes the idea of compressed air failure and gives notice of its re-establishment.

The compressed air haulage plant at Port Chalmette was of superior design, and its efficiency was admitted. Those who followed the installation of the Porter locomotives at Port Chalmette were astonished at the report of the apparent failure, and especially when no sufficient evidence was given as to the cause.

Monon Railroad Shop.

When the "Monon" Railroad erected new shops at Lafayette, Indiana, about a year ago, they installed 10" x 10¼" x 12" Piston Inlet Class "A" Air Compressor, which they considered would be ample to operate any compressed air appliance they might put in for some time to come.

The use of compressed air has grown so rapidly in this shop that an order was recently placed for a Duplex Ingersoll-Sergeant Compressor, with both steam and air cylinders compounded and of about four times the capacity of the original machine installed.

At present they are using, in connection with the small compressor, air appliances as follows, some of which we illustrate and describe in detail; the description being kindly furnished to us by Mr. Charles Coller, Master Car Builder of the road.

FIG. 1. HOSE PRESS.—A bench 30" wide, 8′ long, set up against shop wall; at each end is an upright post, 9" x 12" x 8′, secured to bench and against wall. To each post is bolted one cylinder, 5" in diameter, 10" stroke. These are old engine steam brake cylinders taken from scrap pile. The one on the right hand is used for clamping hose, having cast dies of different sizes for the different sized hose. These dies slip into the cast iron blocks,

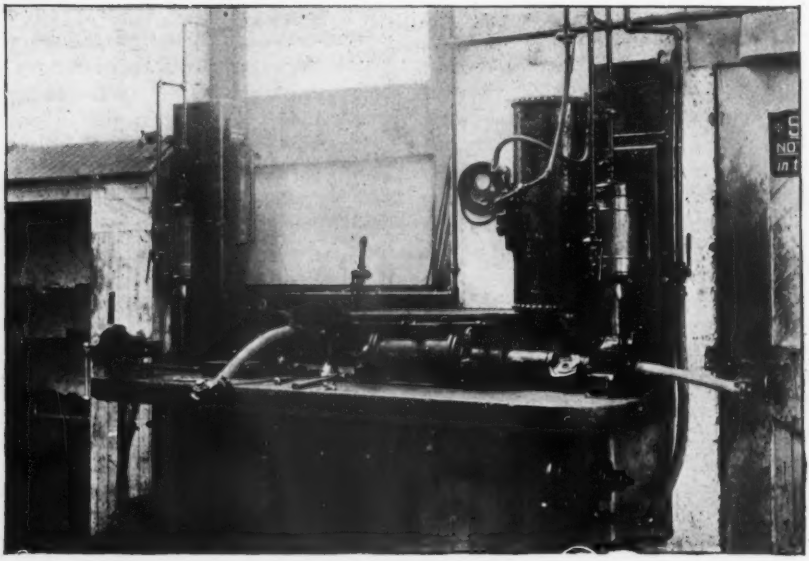


FIG. 1. HOSE PRESS.

which are fulcrumed to piston rod on cylinder, and the lower one is bolted to top of bench. The cylinder on the left has piston rod connected to the long arm of the tongs, or clamp, which is pivoted to a fulcrum bolted to bench. This is used for clamping hose bands onto hose while bolt is being inserted; is also used for cutting old hose off couplings.

The 8" x 12" freight air cylinder shown is bolted on top of bench. There are a series of dies which fit into the end of the piston shank, which hold all patterns of steam and air hose couplings and nipples to proper position to be inserted into hose. Above this cylinder is a shelf set up on brackets, upon which, standing in an upright position, is an auxiliary reservoir. This is used for testing plain triple valves. On the upper side of the bench is bolted a freight car auxiliary and cylinder complete. This is used for testing quick-action triple valves. At the end of bench, to the left, is one air brake and one signal hose, which are attached to pipe leading from main reservoir. To these hose, all hose fitted up are coupled and a cap or plug put on the opposite end, and full pressure is turned on in order to be positive the hose leaves the shop in good condition with regard to leakage.

FIG. 2. CAR LIFTING JACK.—Used for lifting coaches. This jack has a piston 15" diameter, with 26" stroke; piston rod is constructed of a piece of pipe 6" in diameter, 30" long. There is a sleeve 5" long on piston, which extends into lower end of pipe and is bolted to same. There is a cap with four lugs, 1½" long, cast on under side, which drops on inside of upper end of pipe. The castings are all malleable iron.

The jack is bolted to a small truck of the warehouse type, being easily moved around shop or yard. Both jacks are operated by one man, the hose running in "Y" shape from jacks to main hose, which has a cock attached to it. There is a ¼" air cock attached to each jack, used for releasing air.

FIG. 3 & 4. CAR WHEEL HOIST.—Used for loading and unloading loose car

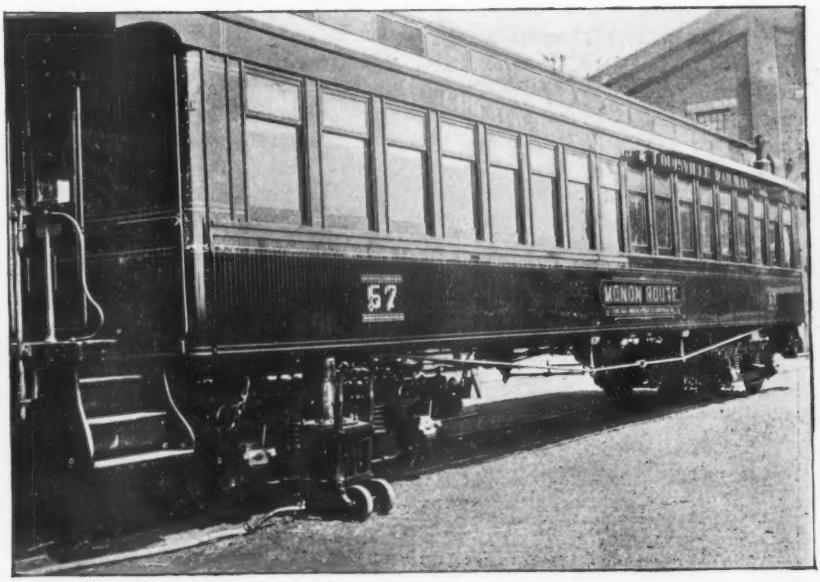


FIG. 2. CAR LIFTING JACK.

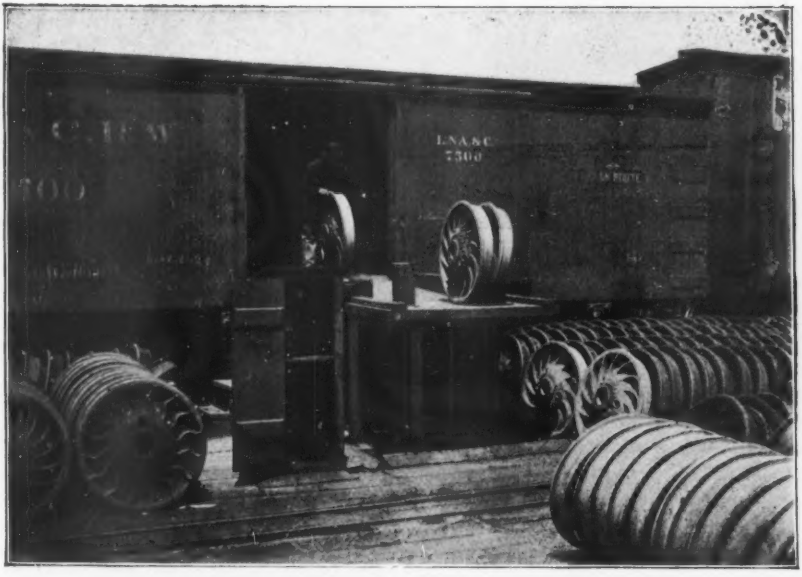


FIG. 3. CAR WHEEL HOIST.

wheels not on axles. There is a pit 3′ wide, 5′ long and 6′ deep in the ground, walled up with brick, and bottom of same laid with grout 6″ deep. On top of this are three pieces of scrap "T" rail bolted to a piece of boiler plate, and to this plate are bolted two cylinders of 7″ pipe, 5′ long. The plunger, or piston rod, is made of 6″ pipe and fastened to piston at lower end, and a cast iron plate, 15″ diameter with sleeve 5″ long, inserted into the upper end. in the posts; on this cross piece rests the stage plank. The end of stage next to hoist is hinged to platform of same. When air is applied this throws stage plank about 6″ inside of car door, and when released it inclines same in a position that will clear car about one foot.

The hoist is operated, and all wheels loaded and unloaded by one man, he taking all numbers and defects, etc., of wheels. Time consumed to load one car

FIG. 4. CAR WHEEL HOIST.

To these plates are bolted a platform of oak timber, 3′ wide by 5′ long, the cross pieces being sandwiched with iron plates. There are two posts, 6″ x 6″ x 20″ long, framed into platform for wheels to rest against. There are four posts set suitable distances between car to be loaded, or unloaded, and the air hoist. These are let into the ground about 3′, and boarded up on each side. The two forward posts nearest car have a piece of oak, 5″ x 5″, with ends rounded and pivoted to fit into slots of 80 to 100 wheels being 50 to 60 minutes; same being done piece-work.

FIG. 5. CAR WHEEL AND AXLE HOIST. —Overhead traveling hoist used for loading and unloading wheels on axles This is constructed of two tripods, the legs of same being 3″ gas pipe fitted to cast iron shoes at the bottom. The shoes rest on blocks of stone, 20″ square, let into the ground and set in grout. Bolts which hold the shoes are let into stone and leaded. The top castings are made to take the

three legs and the ends of the two "I" beams of 5″ height and 30′ long; these being trussed on under side with 1″ rods. The trolley is constructed of four wheels, 12″ diameter, with flanges on outside, and have axles of 1½″ diameter. To this is suspended a hanger, made "V" shape, which is made of 1¼″ x 4½″ iron. Suspended to this, by a clevis, is a cylinder 10″ diameter, 5′ stroke. Alongside of car track, and running in opposite direction, for one man to roll a pair of wheels on same from press platform, or any one of the cross tracks, running same out and rolling wheels off on track directly under hoist.

Usually two men operate this hoist loading and unloading—one man on the car, and the other on the car handling wheels. A car consisting of 14 to 18 pairs of wheels is loaded, or unloaded, in 20 to 30 minutes; same being done piece-work.

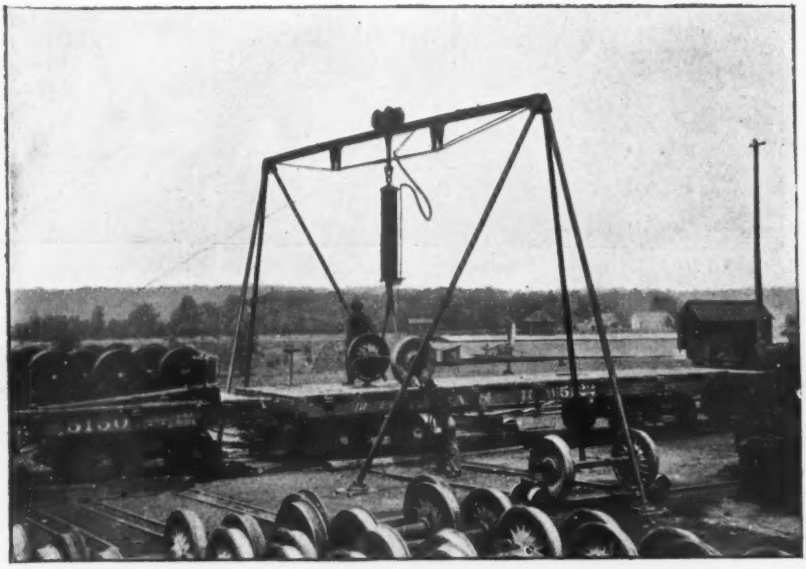


FIG. 5. CAR WHEEL AND AXLE HOIST.

is a series of tracks on which wheels are stored. Running parallel with car track, and about 20′ from same, is a track of 20″ gauge. This divides the series of tracks mentioned above; on one side are stored the wheels for shipment, and on the other side the old wheels unloaded. This track runs through the shop, alongside axle lathes and wheel press. On this track is a truck, the top of which is on a level with top of rails on cross track and top of platform of wheel press, making it easy work

FIG. 6. CARPET NOZZLE.—Showing an air nozzle used for cleaning carpets, cushions, etc., and interior of coaches; this appliance being in use in most railroad shops employing compressed air.

FIG. 7. PNEUMATIC SCRAP SHEARS.—This is an old-time tool, being made of boiler plates by one of the veteran boiler makers in charge of this company's boiler shop, some forty years ago. It was consigned to a resting place in the scrap yard, but when the "air" fever struck us we

FIG. 6. CARPET NOZZLE.

considered it economy to set this tool up again, attach a 14" car cylinder to it and operate same in our scrap shed, for cutting off old bolts, instead of trucking same into shop and then trucking the scrap cuttings out again to the pile. With one man and a pressure of 60 pounds of air, this veteran tool is cutting off all old bolts 1¼", and under, in scrap shed, the only handling being to take them to the screw machine to be threaded, and our supply is kept up in good shape in the bolt room and a small stock carried in scrap pile.

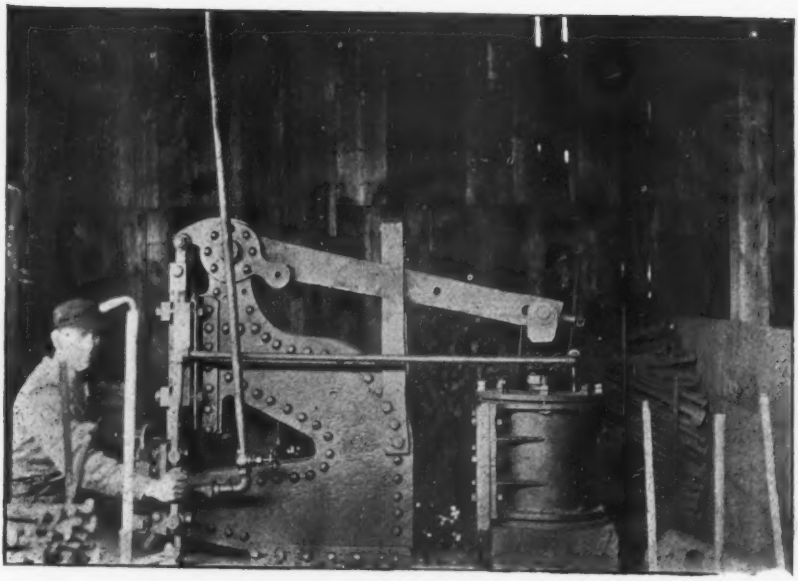
FIG. 8. PNEUMATIC PUNCH.—This tool is a brother to the shears, as described and shown in photograph Fig. 7. It is made in the same manner, and about the same time, and, like the old shears, we took pity upon this tool in its old age and applied the elixir of life through a second-hand 10 x 12" car cylinder and set it up in the shop, and at first trial punched a ⅜" hole through ½" iron with 50 pounds air pressure. We punch at the rate of six holes per minute in ¼" to ⅜" iron with punches of same diameter.

FIG. 9. AIR COMPRESSOR.—This shows the small Piston Inlet Air Compressor now being used to operate the pneumatic tools. This machine will shortly be replaced by the Cross Compound Compressor of the following dimensions :

High pressure steam cylinder,	14"	in diam.
Low " " "	26"	"
Low pressure air cylinder,	22¼"	"
High " " "	14¼"	"
Stroke, 18".		

This machine will be proportioned for a steam and air pressure of 125 pounds.

OVERHEAD TROLLEY TIMBER HOIST—(not illustrated).—This is used in wood machine shop. There is a track leading from lumber yard through the shop; on one side of track is a heavy four-side timber dresser; on the other side and adjoining track is a 40" cut-off saw; 12' back of this is a Fay Planer. Above these, running in opposite direction, is suspended a



No. 7. Pneumatic Scrap Shears.

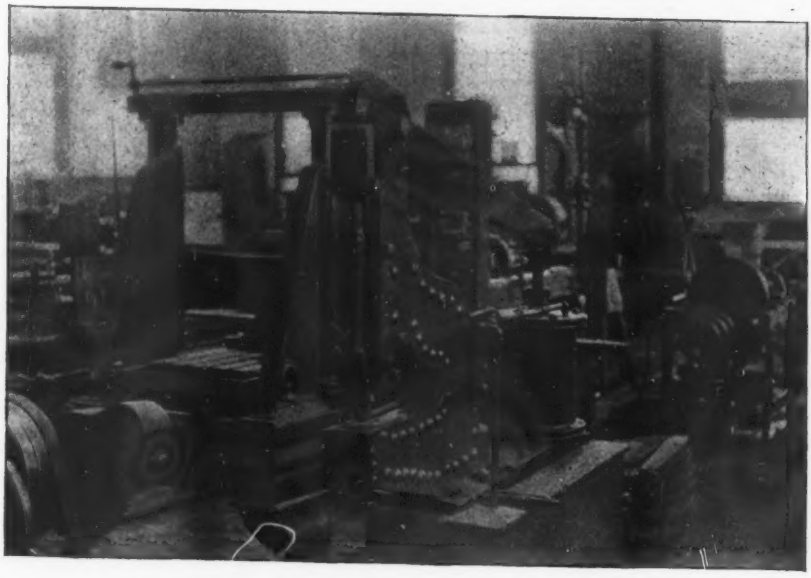


Fig. 8. Pneumatic Punch.

trolley track, 40′ long. Suspended from this is an air hoist, cylinder 5″ diameter with 4′ stroke. Attached to this is a half-inch hose running from distributing air pipe. There is a reducing valve between pipe and hose. On lower end of piston rod there is slipped a spiral spring to relieve any shock to trolley when the air is applied too suddenly. This, however, never occurs when the reducing valve is in good order.

A truck is loaded with heavy timber in the yard and run into the shop. The timber is then picked up by the hoist and conveyed to cut-off saw, and from saw to either side of track to planers.

There were formerly two men employed at this saw, cutting off and trucking timber; the work is now done by one man. There is a rope, with each end attached to hoist and passing over sheave at end of trolley. The operator stands at the saw and moves the timber to either side of the shop with little exertion. The timber suspended from hoist is of the following dimensions: 7½″ x 12½″ x 19″.

LIFTING JACK—(not illustrated.)—Used at wheel turning lathe. This is constructed of two cast-off 5″ x 10″ steam cylinders bolted to a block 9″ x 12″. There is a piece of boiler steel formed to fit the shape of the axle and fulcrumed to each piston rod, which is set in middle of lathe. Wheels are run into shop on track mentioned before as being used for transferring wheels; there are two pieces of timber laid across lathe pit and againft truck.

Other air tools at present in operation in these shops are as follows:

MACHINE SHOP.

Three (3) Rotary Drilling and Tapping Machines.

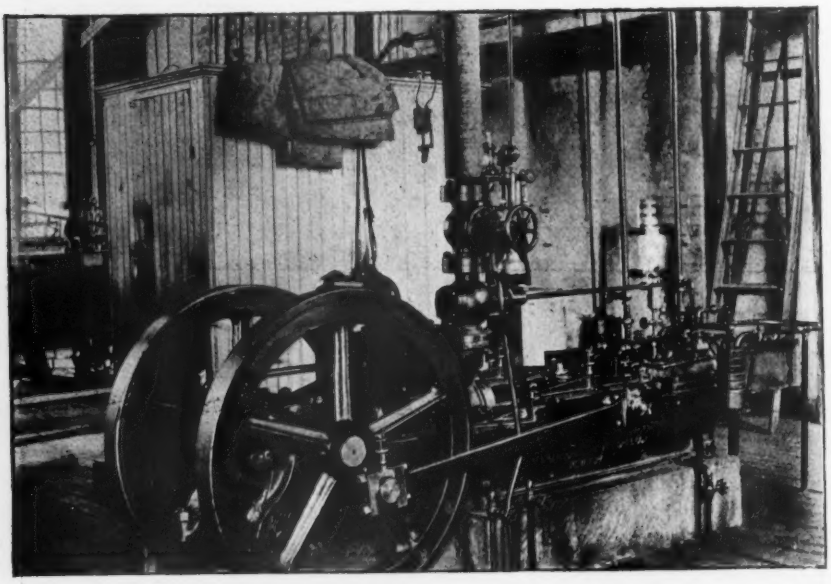


FIG. 9. AIR COMPRESSOR.

BOILER SHOP.

One (1) Punch for sheet iron.
One (1) Punch for boiler plate.
One (1) 14″ Hoist.
Two (2) Caulking Tools.
One (1) Stay Bolt Breaker.
One (1) Stay Bolt Cutter.

BLACKSMITH SHOP.

One (1) Small Bulldoser.
Two (2) Babbitt Melting Furnaces.

CAR DEPARTMENT.

One (1) 10 x 12 Press for pressing oil out of waste.

Air is also used for cleaning lubricators, testing air brake pumps and testing air brakes.

COMMUNICATIONS.

Under this heading will be published inquiries addressed to the Editor of COMPRESSED AIR. We wish to encourage our readers in the practice of making inquiries and expressing opinions.

We request that the rules governing such correspondence will be observed, viz: all communications should be written on one side of the paper only: they should be short and to the point.

Editor "Compressed Air":

1. How can I determine the amount of power that may be realized from a reservoir of known dimensions, charged with air at 225 pounds pressure?

2. How can I determine the amount of power that it requires to compress this air?

3. Why does heat accumulate in a compressed air reservoir?

4. Is there any book published which treats of the above subject in a simple way? and if so, give title and publisher.

W. H. WAKEMAN.

[1. First determine the cubical contents of Receiver (cu. ft.,) and multiply by

$$\frac{(225 + 15)}{15} = 16$$

Product will be = cu. ft. of free air in reservoir.

All depends upon the manner in which you are going to use the air. If used in a motor, the cut-off is an important factor; and if air is reheated, the quantity consumed for a given power will be proportionately diminished.

We refer you to Table, page 117, COMPRESSED AIR, No. 8, Vol. I., which will give you the consumption in free air for varying cut-off and for pressures up to 150 lbs. For pressures up to 225 see general formula, page 69, COMPRESSED AIR, No. 5, Vol. I.

2. We refer you to any treatise on thermodynamics for a mathematical formula; or you will find in "Kent's" or "Haswell's" (64th edition) Pocket Books, a table of mean effective pressures for pressures up to 200 lbs., from which you can compute the horse power for any given case.

3. The heat that accumulates in a compressed air reservoir is due to the heat of compression in the air cylinder—due to work done upon the air in compression. See COMPRESSED AIR, No. 3, Vol. I., page 14.

4. Refer to Frank Richards' book.—ED.]

Editor "Compressed Air":

The following shows a simple method of calculating volumes of free air. It entirely obviates the tedious division by 14.7, and is correct.

I shall be pleased if it is of any use, or worthy of a corner in your most interesting journal.

To find the equivalent volume of free air corresponding to a given volume of compressed air under any pressure—one atmosphere being = 14.7 lbs. per square inch.

$$\left.\begin{matrix}\text{Volume}\\ \text{free air}\end{matrix}\right\} = \left.\begin{matrix}\text{Volume}\\ \text{comp. air}\end{matrix}\right\} \times (0.068\ p+1)$$

p being the gauge pressure in lbs. per sq. inch.

EXAMPLE.

Find the equivalent in free air of 78 cu. ft. compressed air at 2500 lbs. pressure per sq. inch.

$$\text{Free air} = 78 \left\{ (0.068 \times 2500) + 1 \right\}$$
$$= 78 \quad (170 + 1)$$
$$= 13338 \text{ cubic feet.}$$

WM. COX.

At the Globe Iron Works, Cleveland, O., a No. 5 Phoenix drill is being used for expanding the flues of a large marine boiler. This work is done by using the machine to drive an ordinary taper pin expander, and an idea of the rapidity with which the work can be accomplished by the use of the machine as stated may be had from the statement that on one boiler 280 3½" flues were expanded in ten hours; this time included all delays. The seams of the boiler are caulked with the Keller 1¾" tool, built by C. H. Haeseler & Co., Philadelphia.

COMPRESSED AIR.

(CONTINUED.)

Fig. 21 illustrates a type of straight line compressor of the larger sizes. The following are the specifications on which these machines are built :

CYLINDERS.—Steam Cylinder, 14 inches in diameter, by 18 inch stroke. Air Cylinder, 14 feet 4 inches in diameter, by 18 inch stroke. Cylinders made of the best cast iron suitable for this purpose, and of proper strength and thickness for carrying 100 pounds pressure, after being re-bored once.

WATER JACKET.—Air Cylinder and heads provided with Water Jackets.

BED PLATE.—Bed Plate of the Box Girder type, made in a single casting. The bed plate to extend throughout the compressor connecting both cylinders and all parts, and strong enough to withstand the severest strain of air compressing work.

BEARINGS.—Bearings to form an integral part of the bed plate, provided with removable bronze boxes, adjustable, accurately bored, and scraped to a true bearing surface.

SHAFT.—Main Shaft of hammered steel, 6 inches diameter in the bearings, turned, finished and key-seated, and free from flaws or other imperfections.

FLY WHEELS —Two square rim Fly Wheels, 6 ft. 0 in. in diameter, with face and edges nicely turned and hubs bored and key-seated to fit shaft. The wheels to weigh when finished not less than 3125 pounds.

CRANK.—Crank pins of best hammered steel and securely fastened in fly wheels, and fly wheels counterbalanced.

VALVE GEAR.—Valve Gear of the slide valve type, with Meyer adjustable cut-off gear.

PISTON ROD.—Piston Rods to extend through back head of steam cylinder and front head of air cylinder, and securely fastened in cross-head.

CROSS-HEAD.—Cross-head of cast steel and amply strong, provided with bronze shoes, and with adjustment for piston rods.

MATERIAL USED.—Piston Rods, Valve Rods, Connecting Rods and Crank Pins, of the best forged steel. Boxes for crank and cross-head pins of composition metal.

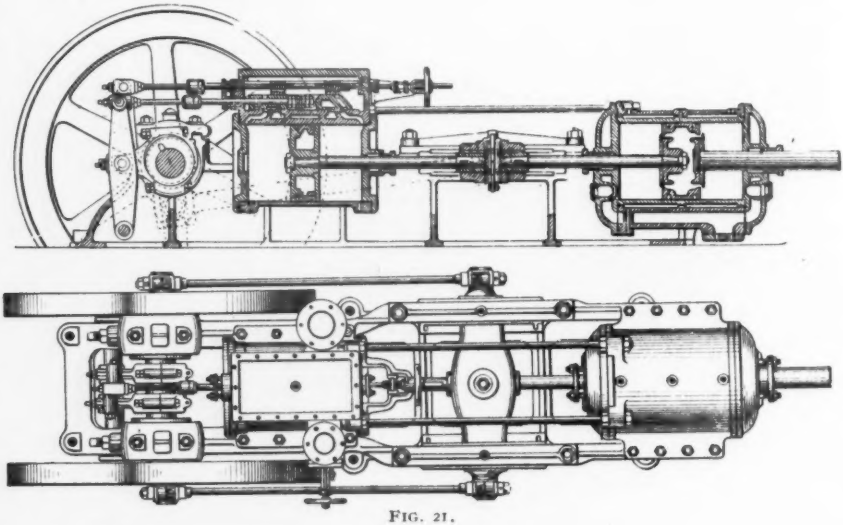


FIG. 21.

THROTTLE VALVE.—Steam Cylinder provided with a Globe Throttle Valve, with flanges and hand wheel turned and polished. Valve provided with drain connection.

GOVERNOR.—The Compressor is provided with an Automatic Pressure Regulator and unloading device.

INDICATOR CONNECTION.—Provision made on both steam and air cylinders for Indicator connections.

OILING DEVICES.—Oil Cups for all wearing parts · one sight feed Lubricator for steam cylinder, one Ingersoll-Sergeant Lubricator for air cylinder. All oiling devices extra large.

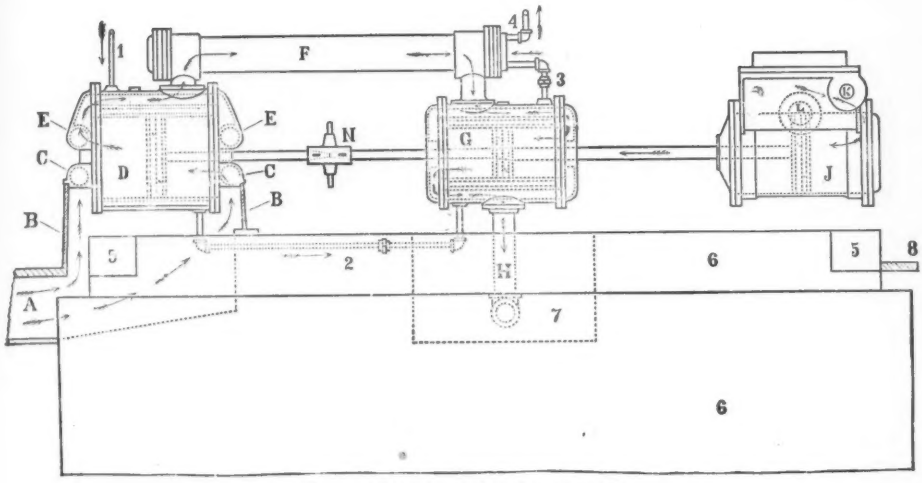


Fig. 22.—Compound Air Compressor.

Arrows on the water pipes show the direction of water circulation. When pistons move as indicated by the arrow on the piston rod, steam and air circulate in direction shown by arrows in the cylinders.

A—Inlet Conduit for Cold Air.
B—Removable Hoods of Wood.
C—Inlet Valve.
D—Intake Cylinder.
E—Discharge Valve.
F—Intercooler.
G—Compressing Cylinder.
H—Discharge Air Pipe.
J—Steam Cylinder.
K—Steam Pipe.
L—Exhaust Steam Pipe.
N—Swivel Connection for Cross-head.
O—Air Relief Valve, to effect easy starting after stopping with all pressure on the pipes.
1—Cold Water Pipe to Cooling Jacket.
2 & 3—Water Pipe.
4—Water Overflow or Discharge.
5—Stone on end of Foundation.
6—Foundation.
7—Space to get at underside of Cylinder.
8—Floor line.

Weight.—Total weight of Compressor ready for shipment, 10,800 pounds.

Where larger volumes of air are required the direct acting type gives place to the compound and duplex. It is not considered good practice to build single compressors with air cylinders larger than 26 inches in diameter, except where the air is compounded.

Fig. 22 illustrates a popular type of Direct Acting Compound Compressor. The merits of this compressor are referred to by the manufacturers as follows:

"The large air cylinder on the left determines the capacity of the Compressor, and for the illustration we have taken its piston at 100 square inches area. The small air cylinder in the centre can have an area of 33 1-3 square inches. The small piston only encounters the heaviest pressure, and at 100 lbs. pressure the resistance to its advance is 3,333 lbs. The resistance against the large piston is its area multiplied by the pressure which is caused by forcing the air from the large cylinder into the smaller cylinder, which is in this case 30 lbs. per square inch. But as this 30 lbs. pressure acts on the back of the small piston and hence assists the machine, the net resistance of forcing the air from the large into the small cylinder is equal to the difference of the area of the two pistons multiplied by the 30 lbs. pressure. This is 66 2-3 by 30, and equals 1999 lbs. Hence 1999 lbs., the resistance to forcing the air from the large into the smaller cylinder plus 3333 lbs., the resistance in the smaller cylinder to compressing it to 100 lbs., is the sum of all the resistances in the compound cylinders at the time of greatest effort. This is 5333 lbs. The time of greatest effort is at the end of the

stroke, or when the engine is passing the centre. In the single machine this resistance is 10,000 lbs., hence we see that in the compound machine the maximum strains are less by over 46 per cent., or nearly one-half. By thus reducing the work to be done at the end of the stroke, more work is done in the first part of the stroke, and the resistance is made nearly uniform for the whole stroke.

"The next step is to render the application of power also uniform for the whole stroke. This is accomplished in a very simple and effective manner. The steam and air pistons and crosshead are mounted on the same piston rod. These parts are purposely given weight enough so that it requires most of the power of the steam over and above the air resistance at the beginning of the stroke to start them forward at the required speed. At the end of the stroke, when the steam has become weak by expansion, the power stored up in the momentum of these reciprocating parts is given out in useful work, and the parts are brought to a state of rest by expending their force upon the air in the compressing cylinders. As the energy which can thus be stored and given out by the reciprocating parts depends upon their weight, and the *square* of the number of revolutions, it is evident that rotative speed is the most important factor. Hence very long strokes are not desirable, because at the same piston speed the machines make fewer revolutions than machines of shorter strokes. Therefore the power is not applied to the work so uniformly, and greater strains are brought on shafts, connecting rods and other parts, and larger fly-wheels, and frequently double engines, are necessary for successful operation, especially when steam is to be used expansively. The value of rotative speed for economical steam consumption is too well known to need reviewing here. It is of interest, however, to note that the quick rotation that is valuable for applying the power uniformly also contributes to steam economy.

"Uniform resistance and uniform power both applied, as in this compressor, as direct end thrust and pull upon a straight steel piston rod, do not leave much work for fly-wheels to perform. Their presence, however, is necessary to regulate the steam valve motions, to control the length of stroke, to even up and balance trifling inequalities of power and resistance and to secure a uniform speed to the machine."

W. L. SAUNDERS.

Latest "Up-To-Date" design of Direct Acting high pressure Duplex Compressor.

TO those using compressed air in their works, it will probably be a matter of interest, to know, that we are now selling for (**$50**) **Fifty Dollars Net a Complete Whitewashing and Painting Machine,** for using one nozzle, of the same capacity, as those used in spraying **"Red Lead Paint"** on the Iron work of the New U. S. Appraiser's Stores in this City. As an item of information we will say, the entire expense for doing this work was less than would have been the cost of Brushes to do this same work! and the work is better done than could have been done by hand—for further information write to

TURNER MACHINE CO.,
35 W. 14th Street, New York.

THE WOLSTENCROFT

PNEUMATIC TOOL CO.,

(FRANKFORD) PHILADELPHIA, PA.

Manufacture Pneumatic Tools as follows:

Size Diameter Hammer.

¼ inch for fine Carving on Onyx and Soft Stones.

⅜ " " fine Carving on Granite and Marble.

½ " " " " " " " "

⅝ " " sunken letters" " " "

¾ " " raised " " " " "

1 " " roughing around letters on Granite and Marble.

1¼ " " heavy cutting on Granite, Blue Stone " "

1⅜ " " chipping and caulking bath boilers and light tank work.

1½ " " beading boiler flues, chipping and caulking locomotive tenders and portable boilers,

1⅝ " " heavy boiler caulking and metal chipping; also for use in scaling armor plates.

1¾ " and 2 inch. diameter hammer Tools, made on order,

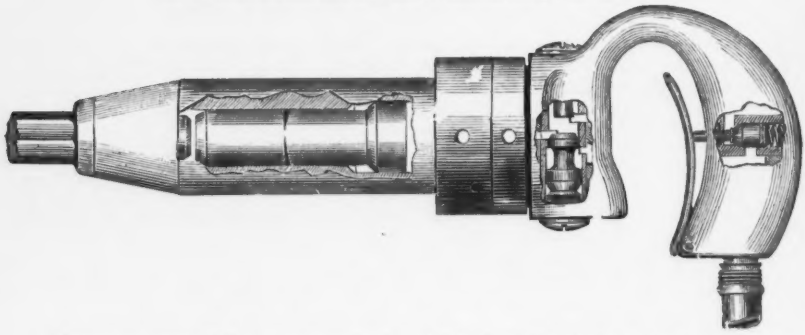
The Patents under which the above Tools are manufactured, have been sustained by the United States Court.

TOOLS SENT TO RESPONSIBLE PARTIES FOR 30 DAYS TRIAL

. . . . . **EFFICIENCY GUARANTEED** . . . .

United States Metallic Packing Co.,

PHILADELPHIA, PA.



Manufacturers of the most economical Air Tools in the market, such as

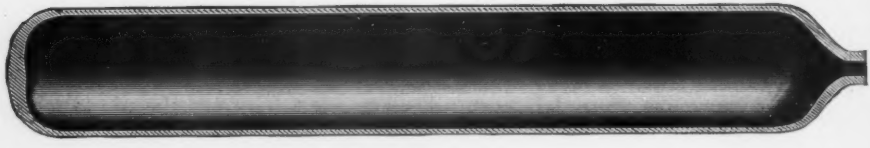
PNEUMATIC HAMMERS,
" DRILLS.
" TRACK SANDERS,
" BELL RINGERS.

METALLIC PACKING FOR ALL KINDS OF SERVICE.

CHICAGO OFFICE:
1003 MARQUETTE BUILDING.

OFFICE AND WORKS:
427 NORTH 13th STREET.

MANNESMANN TUBE WORKS,



MANUFACTURERS OF

Seamless Rolled Tubes for Gases, Compressed Air, Etc.,

UNDER HIGH PRESSURE.

Tested and approved by the highest authorities and Governments of Europe and America.

Each Tube is carefully tested, and a Government Test Certificate is furnished with each Tube. Representatives:—

CHAS. G. ECKSTEIN & CO.,

45 VESEY STREET, - - - NEW YORK.

Do You Roast Your Ores?

. . . . YOU CAN SAVE . . . .

FUEL, COST OF REPAIRS AND LABOR,

BY USING

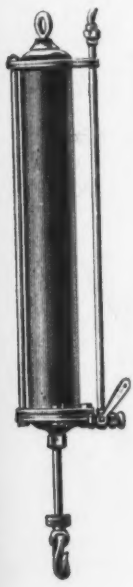
The Ropp Straight Line Furnace,

FOR SALE BY

PARKE & LACY CO.,

21 & 23 Fremont Street, San Francisco, Cal.

SOLE LICENSEES. CATALOGUE UPON APPLICATION.



THE "NASON" AIR-HOIST

. . CYLINDERS . .

For use in conjunction with Compressed Air.

Made in sizes of from 2 in. to 8 in inside diameter, with lift of hoist from two to ten feet.

CONTRACTORS FOR

The Installation of Pneumatic Hoisting Apparatus.

. . . SAFE, SIMPLE AND RELIABLE . . .

Correspondence Solicited.

NASON MANUFACTURING CO.,

71 BEEKMAN STREET, NEW YORK.

THE PULSOMETER STEAM PUMP

"The Contractor's Friend."

OFTEN IMITATED—NEVER EQUALED.
OVER 20,000 IN USE.

Recent Important Improvements.

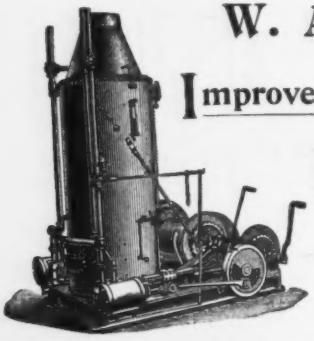
The Handiest, Simplest and Most Efficient Steam Pump for General Low Service Mining, Quarrying, Railroad, Irrigating, Drainage, Coal-washing, Tank-filling, Paper Mill, Sewer and Bridge Contractors' Purposes, etc., etc.

Muddy or gritty liquids handled without injury to the Pump.

PULSOMETER STEAM PUMP CO.

Catalogue on Application. **Correspondence Solicited.**

135 GREENWICH STREET, NEW YORK.



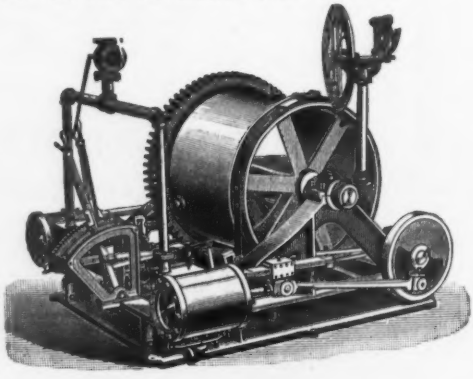
W. A. CROOK & BRO.'S CO.,

Manufacturers of

Improved Hoisting Engines,

FOR PILE DRIVING, RAILROADS, BRIDGE BUILDING, MINES, QUARRIES, COAL HOISTING AND BUILDING PURPOSES.

BUILT ON THE DUPLICATE PART SYSTEM.



OVER 350 SIZES AND STYLES.

Log Hauling by Steam and Suspension Cableways.

BOSTON OFFICE:
47 Pearl Street, cor. Franklin.

MAIN OFFICE AND FACTORY:
117-123 Poinier Street, Newark, N. J

SALESROOM:
143 Liberty Street, - New York.

— ON ADMIRALTY AND WAR OFFICE LISTS.—

THE MANNESMANN TUBE Co. Ld.

LANDORE R.S.O. SOUTH WALES.

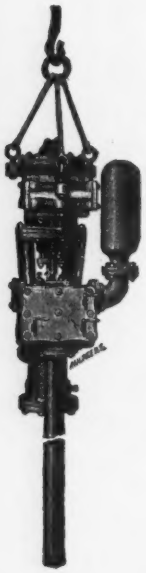
D. B. McILWAINE,

SOLE AGENT FOR AMERICA,

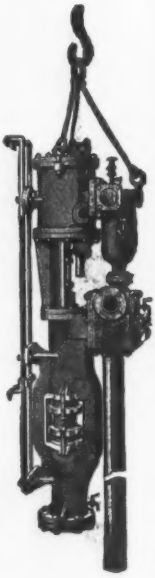
NEW YORK OFFICE:

122 Chambers Street, New York.

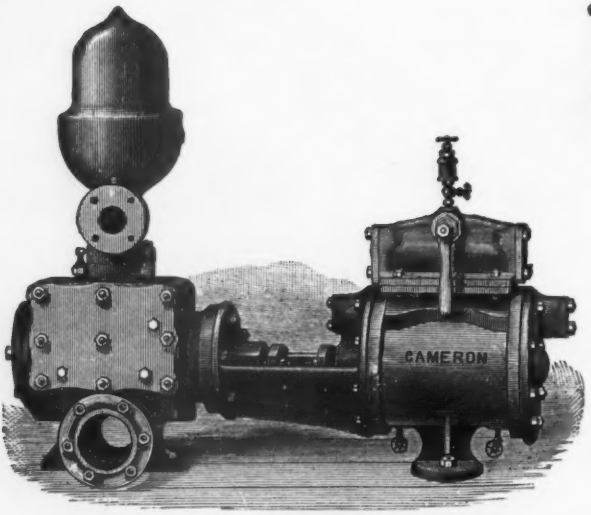
CAMERON STEAM PUMPS.



Simple,
Compact,
Durable,
Efficient.



NO OUTSIDE VALVE GEAR.



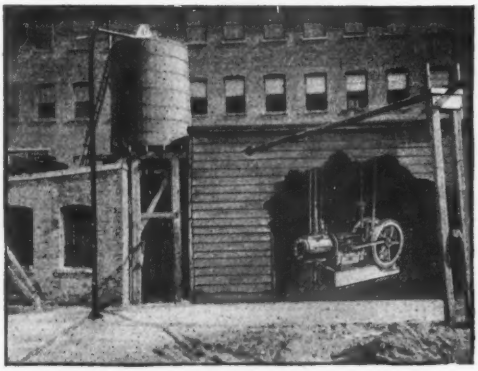
ADAPTED TO EVERY POSSIBLE DUTY.

MANUFACTURED BY

THE A. S. CAMERON STEAM PUMP WORKS,

Foot East 23d Street, New York.

Water Pumped by Compressed Air.



POHLE AIR LIFT PUMP IN OPERATION.

THE INGERSOLL-SERGEANT DRILL CO.,
PNEUMATIC DEPARTMENT,
HAVEMEYER BUILDING, - - - - - NEW YORK.

THE
ENGINEERING
MAGAZINE
AN INDUSTRIAL REVIEW

The Engineering Magazine has been aptly described as "*The Century* of the industrial world and the *Review of Reviews* to engineering literature—the two in one." Its leading articles treat the subjects uppermost in importance in industrial affairs. Its contributors include the foremost men of our times. It gives each month an exhaustive Review and Index to the world-wide range of technical literature—American, English, French, and German. It is read in every nook and corner of the civilized world. It is founded upon the idea of meeting the requirements of the busy and brainy men who manage, think, and plan for the engineering, architectural, electrical, railroad, mining, and mechanical industries. It has a larger bona-fide circulation among such men than has ever been attained by an engineering journal in all the history of industrial literature. It is priceless to the active man who needs to keep in touch with current developments. Its every page carries a living interest for intelligent readers who are in any way concerned with modern industrial enterprises. Its subscribers are its warmest advocates and the Magazine itself is its best solicitor. *Sample copy free.*

30 Cents a Number; $3.00 a Year.
THE ENGINEERING MAGAZINE,
120-122 Liberty St., New-York, U. S. A.

Compressed Air.

Practical information upon Air-Compression and the Transmission and Application of Compressed Air.

By FRANK RICHARDS. 12mo, cloth, $1.50
John Wiley & Sons, New York.

Would you like to make some extra money?

We will give a very liberal commission to any one who can make up a club of ten subscribers.

Write for terms,
COMPRESSED AIR,
26 Cortlandt Street, N. Y.

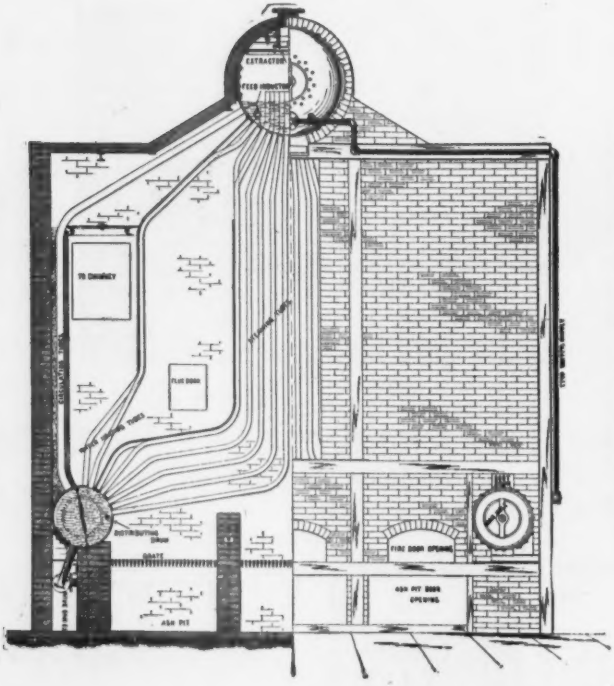
Patents, Trade Marks, Designs.

Searches as to Novelty; Reports on Infringements, Patent Matters Exclusively; 15 Years Experience.
Refers to Publishers this Magazine.
FRANKLAND JANNUS,
Attorney-at-Law, Atlantic Bld., Washington, D. C.

Always have Title Examined before Investing in Patent Property.

HOGAN WATER TUBE BOILERS

PERFECT IN DESIGN.



UNSURPASSED IN ECONOMY.

Always give entire satisfaction. Combines every desirable feature in boiler construction and design.

SAFE, EFFICIENT, DURABLE, FREE FROM SCALE on heating surfaces. Has POSITIVE and CONTINUOUS CIRCULATION. Need no feed water heaters or steam separators.

Delivers all steam above the water line.

The WATER LINE is STEADIER than can be found in ANY OTHER WATER TUBE BOILER.

. . . Manufactured by .

HOGAN BOILER COMPANY, MIDDLETOWN, N. Y.

☞ STEAM AND AIR DRILL HOSE A SPECIALTY.

THE MANHATTAN RUBBER MF'G CO.

CABLE ADDRESS "MIALOGIA"
TELEPHONE, 2965 CORTLANDT

Steam Packing,
Pump Valves,
Air Compressor Valves,
Rubber Belts,
Car Springs,
Gaskets,
Suction Hose,
Emery Wheels,

THE MANHATTAN RUBBER MFG. CO 64 CORTLANDT ST. N.Y.

FRANK CAZENOVE JONES,
PRES'T AND GEN'L M'G'R.

ALL KINDS OF MECHANICAL RUBBER GOODS.

Factories: Passaic, N. J. (on D. L. & W. R. R.)

General Office and Salesroom: 64 CORTLANDT ST., NEW YORK.

SEND FOR ILLUSTRATED CATALOGUE.

Electric Blasting.

Victor Electric Platinum Fuses.
Superior to all others for exploding any make of dynamite or blasting powder. Each fuse folded separately and packed in neat paper boxes of 50 each. All tested and warranted. Single and double strength, with any length of wires.

"Pull Up" Blasting Machine.
The strongest and most powerful machine ever made for electric blasting. No. 3 fires 30 holes. No. 4 fires 50 holes. No. 5 fires 100 holes. They are especially adapted for submarine blasting, large railroad quarrying and mining works.

Victor Blasting Machine.
No. 1 fires 5 to 8 holes; weighs only 15 lbs., adapted for prospectling, stump blasting, well sinking, etc.

STANDARD ELECTRIC FUSE AND BLAST TESTER, WIRE REELS (New Design), LEADING AND CONNECTING WIRE.

MANUFACTURED ONLY BY

JAMES MACBETH & CO., 128 Maiden Lane, New York City

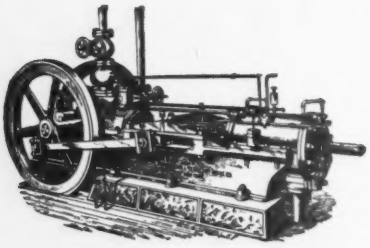
Air Compressors

Of Every Type and for all Pressures

FOR

RAILROAD SHOP Equipment,

Switches and Signals, Etc.



Used by the Erie, P. R.R., P. & R., C C. C. & St. L., "Monon," C & N. W., C. R.R. of N. J., B. & M., A. T. S Fe. and many others.

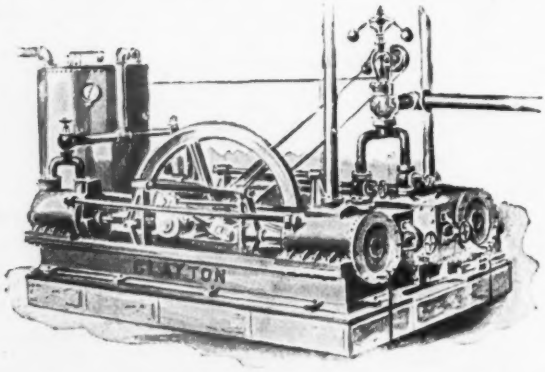
ROCK DRILLS.
CHANNELERS.
COAL CUTTERS.

THE Ingersoll-Sergeant Drill Co.

HAVEMEYER BUILDING, NEW YORK.

AIR COMPRESSORS

For All Purposes and Pressures.



Compressed Air Tools and Appliances.

Clayton Air Compressor Works,

HAVEMEYER BUILDING,

26 CORTLANDT STREET, - - NEW YORK.